APPENDIX H: MONITORING DONE BY OTHER AGENCIES ON ADJACENT LANDS

United States Department of Agriculture, U.S. Forest Service

Sierra Nevada Framework

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The following sections are excerpted from Sierra Nevada Framework PA Final Supplemental Environmental Impact Statement, January 2004 – Alternative S2 – Proposed Action. Monitoring that would be conducted if the Proposed Action is implemented is summarized.

California Spotted Owl

A paired study (treated/untreated) of protected activity centers (PACs) would be initiated to test the response of the species to fuels treatment activities in the most sensitive habitat areas. In addition, landscape-level studies would be designed to evaluate response of the species to different degrees of habitat modification at a larger scale. It is anticipated that the latter studies would provide a template for assessing the effectiveness of the overall fuels strategy over time, depending on the extent to which natural wildfires overlap with treated landscapes. The aforementioned studies would be integrated into ongoing research projects, where possible.

Pacific Fisher

Given the status of this species and the potential risk of habitat alterations to fisher survival and reproduction, monitoring and research activities are deemed immediate needs. Accordingly, four issues from the 2001 adaptive management strategy are presented here.

- What is the status and change of the geographic distribution, abundance, reproductive success, and survivorship of the fisher population?
- What is the near-term effect of the timing, extent, and type of fire and fuel treatments on site occupancy by fisher?
- What are the habitat relationships of the fisher at the stand, home range, and landscape scales, particularly in relation to den sites? Do existing data on habitat relationships accurately represent habitat of fishers?
- What are the reproduction and mortality rates of fishers and what environmental features are potentially influential?

Based on the current assessment of information on fisher, under Alternative S2, the following activities will constitute the initial program of work to reduce management uncertainty about this species.

1. The regionwide status and change monitoring efforts for fisher would be sustained. This monitoring (described in the adaptive management strategy of the SNFPA FEIS) has been implemented during FY 02 and 03. The first complete sample of the fisher population monitoring program will be completed during mid-November 2003.

The ongoing monitoring program is indispensable because it provides the best information on the most important barometer of fisher population health in the Sierra: its distribution. As fisher distribution increases and is restored to its former range, it will be easier to consider a variety of forest management options. The results of the last two years of monitoring indicate that fishers are well distributed on the Sequoia and Sierra National Forests. In fact, comparing the recent distribution of detections on Sierra NF to those from about six years ago one could be tempted to conclude that the number of sites with detections is increasing. Should the population expand north, continued monitoring will allow documentation of the expansion of the species' range into the Stanislaus NF and northward. This program is essential to updating the existing state of knowledge regarding the fisher's distribution and, as a result, determining whether management actions are either fostering the expansion of fishers in the Sierra Nevada, or at least not reducing the area of the occupied range. This status and change monitoring program will be continued in 2005 and beyond, until it can be determined that the fisher has recolonized suitable habitat within its historical range.

2. Analysis and publication of specific active research efforts that support adaptive management would be supported. A number of ongoing research efforts will result in products that can help managers evaluate the effects of vegetation management on the habitat of fishers. These include models that have been developed from field data and that can be used to estimate fisher habitat value at a number of spatial scales. These models can be used to evaluate how changes in vegetation structure, at the plot and the landscape pixel scale, affect the predicted suitability. Thus, they can be used to evaluate changes that occur on the ground or to evaluate simulated changes in stands or landscapes. These tools will be valuable in addressing the effect of specific fuels treatments on habitat value as well as evaluating the cumulative effects (in space and time) of vegetation treatments at the watershed level and across the entire range of the fisher in the Sierra Nevada.

3. The third and final year of a three-year study of fisher in the Kings River area would be completed (through UC Berkeley). In 2004 data will be collected from this population to estimate population density, survival, and the proportion of females reproducing over the period of 2001 through 2004. Preliminary results on reproduction (based on a limited sample) show that 20 to 83% of captured females had likely reproduced in a given year, with an overall average of 48% of the 29 females captured since 1999 showing signs of having reproduced in the winter/spring prior to capture.

4. The feasibility of conducting cause and effect monitoring and vital signs research for the fisher would be investigated. The effects of Alternative S2 on fisher habitat are largely unknown, and there is an urgent need to understand the effects of proposed fuels treatments on fishers and habitat elements important to them. There is a lack of understanding of the direct effects on fisher behavior and on the habitat choices they make when confronted with landscapes that have been modified to reduce the severity of threat to fire. This can only be determined with experiments that involve the animals themselves. Unfortunately, the fisher occurs at naturally low densities and treatments may affect only a portion of their home range each year. Thus, study areas must be very large to achieve a sufficient sample of animals and treatments must be applied in a manner regulated by the experimenter. These characteristics suggest that it may not be possible, within realistic budgets, to conduct an experiment that will be able to reject the hypothesis that treatments have no effects on fishers. The feasibility of this type of experiment must be evaluated. This is not a trival exercise and it will require the time of research scientists and statisticians to evaluate (perhaps via simulation) various study designs. Until this exercise is completed, it is not possible for scientists to recommend the type of experiment that will be successful at determining if treatments (the 'cause') do not change the probability of fishers persisting and reproducing in treated areas (the 'effect').

It is also important to study fisher survival and reproduction in the Sierra Nevada and how they may vary in landscapes with different characterisitics and different levels of fuels treatments. This subject, too, requires a feasibility analysis to determine if sufficient data can be collected to determine if treatments have negative, positive or neutral effects on survival and reproductive rates. The feasibility analysis will result in conclusions about cost and value of conducting studies of vital rates, especially in conjunction with other monitoring and adaptive management actions that may be implemented on behalf of fishers. If the feasibility studies determine that cause and effect experimentation and vital signs research would have a high probability of success, implementation of a pilot project would be a logical next step.

Note: What is USFS doing regarding marten?

Yosemite Toad

There are several information gaps that create uncertainty regarding the Yosemite toad. Basic life history (e.g., longevity, fecundity), population dynamics, and metapopulation characteristics are poorly known. Habitat associations are better understood, but research is needed on seasonal and life stage variations in habitat requirements. While there is fairly good qualitative information on the historic and current distributions of the species, a quantitative range-wide analysis of its status is needed (FEIS, volume 4, pages E-91-E-92). This work has been initiated by a regionwide status and trend monitoring program and results are beginning to fill in information gaps.

Again, a subset of the monitoring and research questions originally identified in Appendix E of the FEIS are brought forward here. These questions are considered the

most crucial, particularly in light of changes proposed in Alternative S2. These questions include:

- What are the direct and indirect effects of various livestock grazing practices on Yosemite toads and their habitat?

- What are the habitat requirements of Yosemite toads at multiple scales (local population and subwatershed/meadow complex) and what is needed to maintain or restore the population and genetic structure of these species?

Based on current assessment of information on the Yosemite toad, under Alternative S2, the following activities would be addressed as the initial program of work to reduce management uncertainties about this species.

Six allotments from the Stanislaus NF and the Sierra NF would be selected for an adaptive management study. Stanislaus NF allotments may include Long Valley/Eagle Meadow, Herring Creek, Highland Lakes, and Cooper. Sierra NF allotments may include Blasingame and Dinkey. The actual allotments selected would be determined in collaboration with forest range specialists, biologists, managers, researchers and the affected permittees.

On each allotment, one or more meadows would be selected as controls (total exclusion of grazing) and the remaining meadows would be grazed according to applicable utilization standards. There would be no limited operating period invoked or exclusion of use on the grazed meadows. Attributes to be studies would include distribution, abundance, and demographic characteristics (e.g. reproductive and survival rates); in-stream, pond and meadow characteristics (e.g. measures of hydrologic regimes, water depth, fine and course sediments, water temperature, and meadow vegetation composition and microclimate); and various livestock grazing practices (e.g. grazing utilization, method, duration, and season).

Site-specific management plans would be developed for some allotments where grazing occurs in occupied Yosemite toad habitat. These management plans would be developed by an interdisciplinary team, and would include a biological evaluation and a monitoring plan.

Willow Flycatcher

The Regional Office would develop a conservation strategy for willow flycatchers in the Sierra Nevada. This conservation strategy would be informed by information contained in the recently completed Willow Flycatcher Conservation Assessment (Green et al. 2003) and would include management recommendations for such issues as meadow condition, monitoring, nest predation, habitat restoration, and cowbird parasitism. The conservation strategy would be an interagency product, incorporating input from the state of California as well as the U.S. Fish and Wildlife Service. Once completed, a

conservation agreement would be used to apply the conservation strategy throughout the range of the willow flycatcher in the Sierra Nevada.

Site-specific management plans would be developed for some allotments where grazing occurs in occupied willow flycatcher habitat. These management plans would be developed by an interdisciplinary team, and would include a biological evaluation and a monitoring plan.

Meadows

The regionwide program of status and change monitoring for meadows will be reviewed and evaluated to ensure inclusion of the appropriate set of elements. Given the range of issues surrounding the ecological condition of montane meadows, the general issue should be addressed as well, or in combination with more specific questions regarding effects of grazing on montane meadows. There is a need to increase understanding of meadow function, the influence of hydrologic regimes on primary productivity, and the influence of fluctuations in weather patterns relative to these issues. Sierra meadows are extremely important to birds, and avian monitoring can provide feedback from a whole suite of organisms within a system making birds a cost-effective, practical alternative for eliciting the necessary feedback of the effects of meadow management. Therefore, a rangewide, multi-taxa monitoring plan for mountain meadows is an important step toward addressing the health of montane meadows. Other aspects of meadow ecology such as hydrological regimes, sedimentation, and vegetation succession should be incorporated into the overall design of montane meadow monitoring

Owl Demographic Studies

There are four ongoing California spotted owl demography studies within the Sierra Nevada bioregion:

- Lassen National forest, 1300 km2 study area (1990-present)
- Eldorado National Forest, 355 km2 study area (1986-present)
- Sierra National Forest, 417 km2 and a 267 km2 study areas (1990 and 1994-present)
- Sequoia and Kings Canyon National Parks, 337 km2 (1990-present)

Another demographic study was conducted on the San Bernadino National Forest from 1987-1998.

Collaborators involved in this long term work include the Dr. Rocky Gutierrez and Mark Seamans from the University of Minnesota (El Dorado study area) , Dr. Barry Noon and Dr. Jennifer Blakesley from Colorado State University (Lassen study area), and researchers at the Pacific Southwest Research Station of the Forest Service (Sierra and Sequoia study areas).

Study objectives vary slightly but generally include all or most of the following:

- estimate densities of spotted owls and occupancy status of owl territories in the study area;
- estimate demographic parameters (survival rates by age and sex, nesting, nest success, productivity and fecundity rates, the rate of change of the population size, and the population structure);
- assess site fidelity of individual owls;
- estimate number of missing and replaced owls;
- quantify distribution of habitats within study areas (Sierra/Sequoia studies only); and
- characterize diets of owls from regurgitated pellets, and compare diets of breeding and nonbreeding pairs during the breeding period (Sierra/Sequoia studies only).

Data from the five demographic studies were analyzed in a meta-analysis conducted by spotted owl biologists in conjunction with scientists with expertise in population biology, statistics, and data analysis (Franklin et al. 2003). Data from the demographic studies comprise the only empirical information on California spotted owl population trends, survival, and reproduction over the past 7-12 years. As recommended in the meta-analysis report, the demographic studies provide a valuable opportunity to conduct adaptive management experiments because of the rich set of baseline data that exists. The authors of the report provide the following recommendations:

1. Develop comprehensive, accurate vegetation maps of the demographic study areas to evaluate the influence of landscape habitat characteristics on variation and trends in demographic parameters;

2. Coordinate the existing demographic studies with forest management activities to develop quasi-experiments on the effects of these activities on demographic parameters; and

3. Design landscape-scale experiments to assess the effects of silvicultural treatments designed to reduce fire risks, and the owl's response to controlled logging and silvicultural treatments.

Currently, the demographic studies do not directly address any of the priority management questions. However, they do provide an unparalleled baseline from which to begin research on some of the causal aspects of California spotted owl behavior. A study of the effects of habitat change on demographic parameters would be consistent with the priority management questions identified above. Because the Lassen study area is part of the HFQLG pilot project area and the Sierra NF study area overlaps with the King River administrative study (see below), the Eldorado NF study area is a prime candidate for studying effects of management activities on the species. The baseline population and reproductive history are well-documented and the study area is of a size that will allow the fuels strategy to be tested at a fireshed scale. Depending on required sample sizes and replicate sites required to reach statistically valid conclusions, it may be possible to address some of the priority management questions with one or two carefully designed experiments conducted inside the pre-existing study area.

Kings River Project

The Kings River Project was developed from the consolidation of the Kings River Administrative Study and ongoing PSW research studies. The project area is large enough (approximately 131,500 acres within the Dinkey Creek and Big Creek watersheds of the Kings River drainage on the Sierra National Forest) to allow replication of experiments, and represents the heterogeneity of southern Sierra ecosystem types. Research study areas range in size from very localized, small plots to small watersheds and landscapes, depending on the species or process being studied. Small mammal plots are 5 acres in size, forest bird study plots are 99 acres, experimental watersheds are 120-560 acres, and owl pair study areas will be 1,000 acres.

The overall purpose of the Kings River Project is to evaluate response of forest ecosystems to a management strategy consisting of a specific uneven-aged silviculture and prescribed fire program. The nature of this program has been defined by the management team from the Sierra NF in consultation with scientists at PSW. There are several study components: the uneven-aged management strategy, the Kings River Experimental Watershed, California spotted owl, fisher, forest birds, and air quality. Some of these components are ongoing, long-term research, while others are newer (such as air quality). In addition to PSW research and case studies, there will be monitoring of effects.

The purpose of the uneven-aged management strategy is to determine if the planned vegetation treatments result in a historic forest structure and composition thought to dominate the western Sierra Nevada before the advent of European influences. The forested portion of the Kings River Project has been divided into 80 management units. Over approximately the first 35 years, all of the units would potentially have projects planned to change the vegetation by applying the uneven-aged management strategy and by periodically underburning.

Specific questions for 25 and 50 years after the initial application of the uneven-aged management strategy and the initial underburning between treated and untreated management units include:

1. What is the difference in tree age, species and size distribution?

2. What is the difference in canopy cover of medium (20-34.9" dbh) and large (>35" dbh) trees?

3. What is the change in total basal area?

4. What are practical considerations, limitations and costs of implementing the Uneven-aged Management Strategy?

For the aquatic systems, the Kings River Experimental Watershed (KREW) is a study within the Kings River Project (led by research scientists at PSW). The intention of the

KREW is to be as holistic and integrated as possible with a focus on headwater stream ecosystems and their associated watersheds. The KREW study is designed as a long-term study with a 15-year minimum period of study that started in the year 2000. The main goals of KREW are to quantify existing condition and variability in characteristics of headwater stream ecosystems and their associated watersheds. Selected measurements for evaluation include nutrient budgets, sediment budgets, stream food web and/or energy budget, geological and geomorphic processes, and vegetation and fuel loading.

Soil Productivity Monitoring

The need for status and change monitoring on soils was evident when the FEIS was written and no quantified data about existing soil conditions over the Sierra Nevada region was available. It was therefore necessary to use a qualitative risk assessment to estimate possible effects on soil productivity from implementing the chosen alternative (USDA Forest Service 2001, Sierra Nevada Forest Plan Amendment FEIS). The lack of knowledge regarding current soil condition and inability to quantitatively predict management effects creates a high level of uncertainty as to whether the qualitative risk assessment accurately predicted potential effects on soil productivity.

Major management related effects, or affecters, which could reduce soil productivity, include use of mechanical fuel treatments; prescribed burning, grazing, and OHV use. The soil quality standards (SQS - see Sierra Nevada Forest Plan Amendment FEIS, Appendix F) define measurable soil properties to be used as indicators of soil health. There has been no previous effort by Region 5 to monitor soil condition over large areas such as the Sierra Nevada. This study plan represents the first attempt to conduct status and change soil monitoring for the Sierra Nevada range.

A Soil Scientist was hired in August 2003 to oversee the monitoring effort. Several Soil Scientists from forests throughout the Sierra Nevada reviewed the draft study plan in July 2003. The following decisions were made to proceed with the study plan completion.

- FIA protocols and personnel will be utilized to collect data for consistency.

- The Sierra Nevada will be stratified so more samples would be gathered in intensive management zones, but other zones also would be monitored.

- FIA protocols under Phase I and II that could provide useful information about soil condition would be used and other protocols would be developed that could be added on to the FIA procedures. Qualitative monitoring protocols would require less time to perform and would increase the number and frequency of observations, while keeping costs within budget.

Several of the same Soil Scientists are still to finalize the stratification and use of qualitative descriptors to provide a greater number of observations. Visual and qualitative classes of soil disturbance would be developed to identify soil displacement,

indications of probable compaction, and soil cover levels. It is anticipated that monitoring would start this coming field season (2004?).

Air Quality Monitoring

The Sierra Nevada is adjacent to areas with some of the most severely degraded air quality in the United States. San Joaquin and Sacramento valley emissions impact terrestrial, aquatic, and visibility resources. Ozone concentrations are historically high and some Sierra vegetation exhibits air pollution-related injury that is likely pre-disposing it to more widespread insect, disease, and drought mortality. Sierra lakes are in the most chemically dilute (lowest capability of neutralizing acidic inputs) group in the U.S., which makes them extremely sensitive to acidification. Contribution of emissions from prescribed burning in forest treatments is being questioned by air quality regulatory agencies.

The Smoke Monitoring Plan developed in the Framework is a mechanism to develop data to support informed management and regulatory decisions. The small budgeted amount is largely used to facilitate other efforts in the Sierra that capitalize on very large well-funded assessments.

EPA relies on recommendations from the Forest Service in the issuance of permits to proposed facilities with significant emissions. The ozone and surface water project monitoring is currently allowing a credible response.

The Lake Monitoring Plan has had synoptic surveys completed in 7 of the 10 Class I areas in the study area. Lakes have been selected in those areas and two years of sampling has been completed by USFS staff.

The Ambient Ozone and Ozone Effects on Vegetation Study Plan was the basis for collaboration with California Air Resources Board (CARB) in 2001 to examine ozone transport via major drainages to the eastern Sierra. The Ambient Ozone and Ozone Effects on Vegetation Study Plan was critical in securing collaboration with CARB and EPA in continuing evaluation of pine plots throughout the Sierra from Sequoia NF to Lassen.

A contract has been awarded to provide instrumentation and service near sensitive communities. This will include near real-time satellite data delivered to a web site to provide assistance with management decisions. Sierra NF and Stanislaus NF will deploy a limited number of instruments and will join the data service contract in 2004.

Meadow Monitoring

The proper ecological functioning of meadows ties to the viability of species dependent on meadow ecosystems. Vegetation condition provides information that addresses habitat needs of a suite of animal species. Study results will be used to determine if Sierra Nevada forests are achieving desired conditions, and to gather baseline data on

meadow condition. Data can be used to develop the baseline necessary for cause and effect monitoring.

Meadows have been selected randomly across the entire bioregion. Sample sites include grazed and ungrazed meadows. Selected meadows have different intensities of grazing and previously grazed meadows have been released from grazing for varied periods of time. Selected meadows support varied levels of recreational activities that can impact animal populations. Meadow monitoring is designed help explain the distribution of animal species that use meadow ecosystems. Plans for meadow monitoring and amphibian habitat monitoring were designed to complement each other.

Vegetation Community Monitoring

A goal in the Sierra Nevada Forest Plan Amendment (SNFPA) FEIS was that forests with old-growth characteristics increase in both area, distribution, and continuity across national forest landscapes. To that end, the goal of this study plan is to describe the status of the quantity and quality of conifer and hardwood forest ecosystems throughout the SNFPA FEIS area, and how they are changing over time. Continued monitoring is required to evaluate the current state and to assess trends toward or away from desired conditions.

Data for status and trend monitoring of forest vegetation has been collected by FIA and contracted field crews for the last three field seasons using the majority of protocols outlined in the study plan. These include data on down woody debris and fuels in addition to vegetation. Additional data collected specifically for the study plan was collected over the last two field seasons. These data currently are being loaded into the new corporate database, and the 2001, 2002, and 2003 data should be available for initial analysis within the next few weeks. In addition to the FIA plots, data from intensification plots designed by the RSL to measure vegetation in rare or unique vegetation types have been collected throughout the SNFPA area, with the additional protocols designed for monitoring.

If the planned sampling rate is continued, the initial measurement will be completed by the end of FY 2006. This will produce an assessment of the current state of forest vegetation as it relates to desired conditions by spring 2007. The analysis will also produce a SNFPA area estimate of fuel levels and their structure. Cause and effect studies related to vegetation and fuels management can be more clearly focused and, therefore, more cost effective using these results.

Landscape Map of Fire

The creation of fire severity maps will allow assessment of how many acres have burned each year, and how each of those acres burned. Maps start with spatial vegetation data and fuels treatment data followed by development of fire severity types. This could allow links to treatment methods that would reduce fire severity over the landscape. This type of information would allow assessment of how well strategically placed treatments

are changing fire severity at a landscape scale. It would enhance our ability to assess current fire regimes and compare those to "historical" fire regimes.

The fire monitoring program has collected data from 786 plots on USFS land and 143 plots on NPS land covering 13 large fires. This data will be used over the next year to finalize the fire severity maps.

Fire severity will also be mapped for all fires in the last 15 years and the data will be combined with current fires to define current fire regimes for two different Landsat scenes; one containing Lake Tahoe, and the other containing Yosemite National Park and the Stanislaus National Forest. These areas will provide an immediate model of fire regimes in several vegetation types, as well as allow refinement of data collection, processing and compilation methods for the next eight years with ground verified data.

Mapping all fires greater than 1000 acres would continue in FY04 with field data for ground verification of the maps. As discussed above, we will use the model based on ground data to go back in time to create fire regime distributions for several vegetation types.

Amphibian Monitoring - Yosemite Toad and Mountain Yellow-legged Frog

Both Yosemite toad and mountain yellow-legged frog are USFWS candidate species (federal listing is warranted). Recent studies and assessments indicate that these species are in decline. Yosemite toads have disappeared from more than 50% and mountain yellow-legged frogs from 70-90% of historic localities. USFS management has potential to contribute to the restoration or continued decline of these species. This monitoring provides essential data on occupancy patterns, the best indicator of population trends for these species. Results represent the entire range of the species, which is the appropriate scale to assess their health and could determine if the Forest Service is meeting desired conditions for Yosemite toad and mountain yellow-legged frog populations and habitat throughout their range in the Sierra Nevada.

Amphibian monitoring occurs in a random selection of small basins (3-4 km2 in size) to determine the status and trend of population (occupancy) and habitat for each species. Two hundred eleven (211) study basins throughout the species range were selected for monitoring. Basin size was reduced in 2003 after analysis of 2002 data. For efficiency, study plans for both species were integrated into one program with the same design and protocols.

Sample basins are visited once in a 5-year monitoring cycle with 20% revisited annually. Population is measured by breeding occupancy (number of basins occupied by tadpoles or egg masses, number of breeding sites per basin) and relative abundance and demography in select basins. Habitat is measured by various attributes that assess 1) hydrologic condition, 2) habitat matrix, 3) cover, 4) water temperature, 5) level of disturbance, and 6) general characterization of the habitat. A relational database in MS Access was developed for data storage.

Two years of occupancy and habitat data have been collected in basins distributed throughout the range of the species, providing information on the Sierra-wide population. Both species have been found in a wider variety of habitats than initially expected. Meadows may be more important for the mountain yellow-legged frog than initially expected. Both species have been found in slow-moving meadow streams. Both species have been found in the basins expected based on the study design.

Inyo National Forest

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Air Quality There is a visibility camera on Mazourka Peak and wilderness ranger monitors visibility during summer months in the John Muir Wilderness (funding provided by Sequoia and Kings Canyon National Parks)
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Soil Productivity Key soil parameters, including porosity, cover, and organic matter have been monitored in arandom sample of prescribed burn areas, fuelwood sale areas, and site prep areas, as well as in compaction monitoring sites in watershed evaluations of specified grazing areas

Wildlife

- **Northern Goshawk** Survey are conducted annually of all known nest sites within areas managed for timber. Occupancy of each territory is determined, and reproductive success is examined where possible.

- **Peregrine Falcon** Staff are implementing USFWS recovery plan. Nesting and reproductive success of peregrine falcons is documented. Field surveys of historic nest areas and high potential nest sites are conducted.

- **Sierra Nevada Mountain Sheep and Nelson Mountain Sheep (with California Department of Fish and Game)** Staff ensures compliance with Forest-wide Standards and Guidelines, and recovery plans. Staff coordinates annual compliance counts with CDFG and evaluate habitat.

- **Winter Bald Eagle Habitats** Inyo NF staff, with other federal, state, and local agencies, are implementing USFWS recovery plan. Staff evaluates trends of habitats delineated to meet recovery goals, determines trend of winter populations, and surveys known winter areas and capability of delineated habitats for specific proposed projects.

- **Pine Marten** Staff have used camera detection techniques on Mammoth Mountain Ski Area to determine species presence, and has analyzed long-term change in available marten habitat within MMSA boundaries.

- **Mule deer (with California Department of Fish and Game)** Annual herd census and demographic assessments are conducted.

- **Songbirds** Monitoring is conducted by Point Reyes Bird Observatory, in cooperation with USFS, BLM, CDFG, MLTSR and private landowners. Monitoring parameters include abundance, richness, diversity and breeding status of songbirds in riparian areas; survival, productivity and parasitism rates of songbirds in riparian habitats.

- **Threatened & Endangered fish (with California Department of Fish and Game)** Owens tui chub and Paiute cutthroat population in North Fork Cottonwood, and Lahontan cutthroat trout in Walker River are monitored. Staffs ensure compliance with USFWS recovery plan and Forestwide Standards and Guidelines. Population inventories were done for existing and reintroduced populations. Analysis of instream habitat parameters was conducted in the South Creek, Fork Kern, Volcano Cottonwood Creek, O'Harrel Creek and Little Hot Creek drainages.

- **Habitat condition of resident trout** **S**taff ensures the integrity and productivity of trout streams are maintained or enhanced through protection of trout habitat factors including streambank stability, bank and stream cover, riparian vegetation, and channel bottom composition.

Vegetation

- **Riparian Vegetation** Field surveys are conducted to ensure management prescriptions and Forest Service guidelines adequately protect meadows and riparian areas and their associated values. Staff ensures spatial and structural vegetation diversity is maintained in riparian areas, determines if mitigation measures for small hydro projects and geothermal development are sufficient and effective in maintaining riparian vegetation and other riparian dependent resources.

- **Sensitive Plants** Species that have been monitored include six Forest Sensitive species (*Abronia alpina, Astragalus monoensis, Caulostramina jaegeri, Cryptantha roosiorum, Dedeckera eurekensis, Lupinus padre-crowleyi*) and four watch list species (*Hackelia brevicula, Oxytropis deflexa* var. *sericea, Sclerocactus polyancistrus, Trifolium macilentum* var. *dedeckerae*). Monitoring is conducted to detect changes in key populations of each species and to assess impacts on selected populations. Key populations that will be used for monitoring purposes are identified. Population trends are monitored, and baseline and past project surveys are used for input into Environmental Assessments.

- **Floristic analysis of the San Joaquin Roadless Area** (MS student, H.M. Constantine-Shull, 2000) Inventories, with quantitative analysis, were conducted of the entire roadless area, with special attention to Glass Creek watershed, and biogeographic affinities of flora in the area were assessed (especially *relevant* to DEPO).

Quantity and Distribution of Snags and Downed Logs Staff ensures minimum quantity, quality, and distribution of snags, and dead and down woody material is maintained. All environmental analyses were conducted with a biologist participate as an interdisciplinary team member. Field monitoring was conducted in conjunction with several timber sales, prescribed burns and the fuelwood collection program. Baseline data were collected for a snag recruitment contract.

Ecological Surveys of Research Natural Areas (Connie Millar, USFS, PSW Research Stn.)
Intensive ecological surveys were conducted for RNAs (similar scale as DEPO) on the Stanislaus, Sierra and Inyo, each of which has a report. These include vegetation mapping, descriptions of the communities, plant and animal species lists, cursory geology and soils, impacts, etc. Those nearest DEPO include the Hall, Indiana Summit, Sentinel Ridge, Big Grizzly Mt, and Teakettle.

Meadow and Forest Conditions (Connie Millar, USFS, PSW Research Stn.) A paper is in revision for the journal *Arctic, Antarctic, and Alpine Research* on 20th century vegetation change that summarizes the following four studies in the eastern Sierra, centered around the Mammoth area:

- tree invasion into meadows (closest to DEPO are Glass Creek, Yost Creek, Spooky Mdws)
- tree invasion into shrinking permanent snowfields
- periodicity of krummholz whitebark pine vertical leader release
- branch length extension in krummholz whitebark pine

The following are not yet published, but are in the analysis and manuscript stage:

- quantitative vegetation plots throughout the Glass Creek watershed
- dating and identification of deadwood on White Wing Mtn.(Glass Ck watershed) for climate reconstruction and dating of Glass Ck vent
- genetic and dendrochronological work on kurmmholz whitebark pine
- dendrochronological work with limber pine

1.6.1.2 USGS

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<u>Monitoring Projects of the Long Valley Caldera and Mono Craters Region</u>

The following information is extracted from USGS Bulletin 2185 - Response Plan for Volcanic Hazards in the Long Valley Caldera and Mono Craters Region, which can be found at http://geopubs.wr.usgs.gov/bulletin/b2185.

The following projects are for the prompt identification of changes in activity for this area. The telemetered networks provide continuous data on seismicity, deformation,

water-well levels, and CO_2 gas concentrations and flux rates for real-time review and analysis on computer systems in the Long Valley Observatory Field Center in Mammoth Lakes, the USGS in Menlo Park in Menlo Park, California and the Cascades Volcanic Observatory in Vancouver, Washington.

- **Seismic Network**
  The Long Valley seismic network was established in summer 1982. It consists of approximately 20 seismic stations within 10 km of the caldera boundary and an additional 15-20 stations within 100 km (60 miles) of the caldera.

- **Differential Magnetic Field and Magnetotelluric Network**
  The local magnetic field in Long Valley Caldera is monitored at 10 sites. The magnetic field data from these stations are sampled automatically every 10 minutes and transmitted to USGS offices in Menlo Park where they are processed and checked.

- **Borehole Strainmeter (Dilatometer) Network**
  Four Sacks-Evertson borehole volumetric strainmeters (dalatometers) installed at depths of 200 m (650 ft) are operated in the Long Valley Caldera-Mono Craters region in a cooperative effort with the Carnegie Institution of Washington. The dilatormeters are sampled automatically every 10 minutes and data are transmitted to USGS offices in Menlo Park by GOES satellite.

- **Tiltmeter Network** There are seven shallow borehole tiltmeter sites. The borehole tiltmeter array is capable of discriminating rapid changes in tilt at the level of 5 to 10 microradians (ppm) occurring within a period of a few days to one week.

- **Geodetic Network** This network includes the two-color Electronic Distance Meter. Since 1983 data have been collected two to three times a week, weather permitting, A GPS Network, which is made up of 16 stations, has been established in the area since 1998. The regional geodetic network involves arrays of monuments that are surveyed on an annual basis using leveling, GPS, gravity, and two-color EDM techniques. This regional network provides long-term definition of the regional deformation field and a regional context for more localized deformation within Long Valley Caldera or along the Mono-Inyo volcanic chain.

Geochemical Monitoring

- **CO_2 soil gas concentrations** Monitoring began in 1995 in the Long Valley Caldera-Mono Craters area at seven monitoring stations. Each station consists of collection chambers buried in the soil. Air from these chambers is pumped to nearby CO_2 sensors housed in USFS structures or culverts. Samples are taken every hour and telemetered every three hours to USGS Cascade Volcano Observatory in Vancouver, Washington, by GOES satellite.

- **CO_2 Flux Monitoring** The discharge rate of CO_2 from areas of diffused gas emission on Mammoth Mountain is monitored both by periodic gas-flux measurements over grids of stations established at several tree-kill areas, and through continuous flux measurements taken at a single automated instrument stationed near Horseshoe Lake during the snow-free portion of each year.

- **Airborne CO_2 Monitoring** Airborne CO_2 surveillance is routinely carried out once or twice a year at Mammoth Mountain to establish baseline CO_2 emission rates for comparison in the event of future increases of unrest. Surveys are accomplished by flying a series of circular orbits with diameters of 6-7 km centered around the mountain's summit at altitudes ranging from 2,895 m (9,500 ft) to 3,657 m (12,000 ft) and with a vertical separation between individual orbits averaging 61m (200 ft). Measurements are made with a nondispersive infrared CO_2 analyzer and flow control unit.

Hydrologic Monitoring This tracks changes in ground-water levels and the discharged of hot springs. Automated measurements of the free-surface water level are measured and recorded by on-site data loggers, and are collected by site visits or are telemetered to GOES satellite. Other wells measure seasonal changes in water-table elevations. In Hot Creek gorge discharge of hot springs is determined from measurements of the differences in chemical flux in the creek at sites both upstream and downstream from the hot spring.

1.6.1.3 Sierra Nevada Aquatic Research Laboratory, UC Santa Barbara

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With a fully equipped modern laboratory and computing facilities, the Sierra Nevada Aquatic Research Laboratory (SNARL) serves as a major center for research for the eastern Sierra Nevada and Owens Valley. The site features a human-made experimental stream system, consisting of nine meandering channels used for research on stream hydrology and ecology. Convict Creek flows year-round through SNARL, feeding the experimental system and providing a natural stream environment protected from grazing and other human impacts. Non-aquatic research is also supported and encouraged on the reserve's pristine habitats, which include Great Basin shrubland and grassland, high desert riparian woodland, and riparian meadow. Another nearby NRS site, Valentine Camp, joins with SNARL to comprise the Valentine Eastern Sierra Reserve (VESR).

Selected Research

Ecology of Mono Lake: UC research since 1976 on Mono Lake influenced a 1994 decision of the State Water Resources Control Board to raise the lake level, helping restore its ecosystem; ongoing projects there include physical-limnology modeling and monitoring of brine shrimp and alkali fly populations.

Sierran snowpack: SNARL scientists operate a snow laboratory on Mammoth Mountain; the National Science Foundation and NASA Earth Observing System Project fund ongoing studies of snowpack properties and snowmelt runoff.

Aquatic biology: Ongoing studies examine impacts of livestock grazing on stream ecology and effects of nonnative trout on Sierra Nevada lake ecosystems.

1.6.1.4 White Mountain Research Station, University of California

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The White Mountain Research Station (WMRS) is a multi-campus research unit of the University of California established in 1950 to provide laboratory, teaching, and housing facilities for researchers doing field work in the eastern Sierra. While WMRS was originally used for research in high-elevation physiology, it is now used also by scientists in such diverse fields as archaeology, astronomy, atmospheric science, ecology, geology, plant biology, and zoology.

A selection of current research:

- Summary of Biological research
- Death Valley Geology
- Millimeter Wave Cosmology
- Biological adaptations to hypoxia
- Owens Valley Dust Trap Project
- Digital Archive of trilobites from the Inyo and White Mountains
- Southwest Great Basin Studies
- WMRS Database Access
- FGDC Clearinghouse
- Watershed-based Interactive Scenario Development Model (WISDM)
- Hydrogen Energy Technologies Integration Center

1.6.1.5 The Nature Conservancy

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The nature Conservancy (TNC) is in the early stages of developing studies and monitoring for an area adjacent to Sequoia National Park. The area is not a preserve per se, but rather is an aggregate of lands managed by a regional land trust in Tulare County, as well as BLM lands in Sheep Ridge. The land primarily supports blue oak and interior live oak woodland and riparian corridors. For additional information on this area, please see http://nature.org/wherewework/northamerica/states/california/preserves/art9767.html

The following was excerpted from TNC website listed above:
"In December 2000, The Nature Conservancy was awarded a grant from the David and Lucile Packard Foundation to develop a conservation plan for the Sequoia Foothills area in conjunction with the newly formed Sierra Los Tulares Land Trust (now the Sequoia Riverlands Trust). This collaborative planning process, completed in April 2002, succeeded not only in producing a compelling vision for regional conservation in Tulare County, but in forging a strong partnership between The Nature Conservancy and the land trust. Moving forward, the Conservancy and the land trust are building on this partnership through an innovative approach that integrates staff resources, jointly raises operating and acquisition funds, and coordinates implementation of strategic acquisitions and land-use planning efforts."

TNC also is developing a new approach to measuring success of their conservation efforts; an ecological factor-based approach; land below Sequoia will be a pilot area to test this approach. The approached is described below.

The Enhanced 5-S Project Management Process

Over the past decade, The Nature Conservancy (TNC) has developed and deployed the 5-S Framework for Conservation Area Planning, which is used to design and measure the effectiveness of conservation strategies.[1]

The five S's include:

- **Systems**: the biodiversity targets occurring at a site, and the natural processes that maintain them, that will be the focus of planning.
- **Stresses**: the types of degradation and impairment afflicting key attributes of the system(s).

[1] **Source:** *5-S Framework for Site Conservation: A Practitioner's Handbook for Site Conservation Planning and Measuring Conservation Success.* The Nature Conservancy (2000).

- **Sources**: the agents generating the stresses.
- **Strategies**: the types of conservation actions deployed to abate sources of stress (threat abatement) and altered attributes of the systems (restoration).
- **Success**: measures of system viability and threat abatement.

The logic underlying the Five-S framework is simple. The implicit conservation goal is to maintain viable occurrences of the systems. By definition, viable occurrences are not significantly stressed. Therefore, the stresses must be abated to ensure viable systems. There are two fundamental approaches to lessen the stress and enhance or maintain the viability of the systems. The first is to abate the sources that are causing the stresses, under the assumption that the stress will subside if the source is removed. The second is to directly abate the stresses that may persist once the source is removed. Thus, conservation strategies are developed and implemented to (1) abate the critical sources of stress (i.e., threat abatement); and (2) directly restore altered key attributes of the systems (i.e., restoration). The measures of conservation success assess the effectiveness of our strategies at accomplishing these outcomes, and provide the feedback for revising strategies, as warranted.

The original 5-S Framework first published in 2000 had a number of strengths but also some weaknesses. For example, the original 5-S framework did not have explicit tools for rigorously measuring viability of systems, conducting a situation analysis, setting explicit goals and objectives, monitoring indicators related to key assumptions, or using the information to then adapt and learn. Developing effective conservation strategies and truly measuring their effectiveness requires an enhanced version of the 5-S Framework that incorporates and emphasizes all the elements of an adaptive management approach.

To this end, TNC's 5-S Framework for Conservation Area Planning has been modified to incorporate more explicit adaptive management steps to produce the Enhanced 5-S Project Management Process. A conservation project can be defined as a set of strategies taken by a defined group of practitioners working to achieve a defined set of goals and objectives within a specified geographic area. TNC has traditionally thought of its conservation areas as its "projects" (thus, the term Conservation Area Planning), but in recent years has begun to take action at larger scales including multiple conservation areas, ecoregions, and states, countries, and other political units.

The Enhanced 5-S Project Management Process involves a seven-step process summarized below. The components of the original 5-S process are referenced in italics within the title of each of the seven steps. Recommended actions within each step are shown as bold, bulleted entries.

Step A. Define Project Scope and Targets (SYSTEMS)

The first step involves defining the basic project scope and selecting the specific conservation targets that the project will focus on. This step helps the project team define what they will be working on and to set up the ultimate measures of success.

- ***Describe project area(s) and project goal***—Provide a brief text description and furnish a basic map of the project area(s) using a computer-based GIS program, existing base map, or hand sketch.
- ***Identify project team and resources***—List the project team members and their roles and complete the resource measures template.
- ***Select minimum set of focal conservation targets***—Choose a small number of focal targets (no more than eight), explain the rationale for their selection, and show the focal target area on a spatial map.

Step B. Assess status of conservation Targets (SYSTEMS)

The second step establishes the current status of the focal conservation targets identified in Step A. We are often challenged by incomplete knowledge on the status of the focal targets but this step captures the best available information using TNC's viability assessment procedures.

- ***Identify key ecological attributes and indicators—***Determine at least one key ecological attribute for each focal conservation target and define the acceptable level of variation of the attribute(s) in terms of measurable indicators and indicator ratings that can be used to assess the overall health of the target.

Step C. Identify Critical threats, underlying causes, and Opportunities (STRESSES & SOURCES)

The third step involves developing an understanding of the various factors that can affect the project's focal conservation targets. This step helps the team identify high leverage points for taking action and understand the situation so that they can measure the impact of their actions.

- ***List direct threats affecting targets—***Identify the direct threats (stresses and sources of stress) affecting the focal conservation targets and identify the highest priority critical threats.
- ***Identify factors behind critical threats—***Outline the factors (underlying causes and opportunities – including important stakeholders) behind each of the critical threats.
- ***Link targets, threats, and other factors in a chain-of-causation and/or conceptual model —***Showing the hypothesized linkage between the factors and targets that have been identified in narrative text, diagrammatic, or symbolic logic forms.

Step D. Develop Conservation Strategies and Compile Action Plan (STRATEGIES)

The fourth step involves deciding on what actions the project team will take to change the situation. This step helps the project team establish objectives against which it will measure its performance.

- ***Set objectives***—State the intended outcomes for those critical threats and degraded key ecological attributes that the project team will actively seek to change.

- ***Develop strategic actions***—Based on the team's understanding and further probing of the situation, brainstorm potential strategic actions to accomplish the objectives, then evaluate and select strategic actions to implement based on benefits, feasibility, and cost.
- ***Compile overall action plan including responsibilities, budget, and timeline—*** Assign specific responsibilities to individuals and develop a budget and timeline.
- ***Add objectives to chain of causation or conceptual model***—Show how strategies will affect project situation.

Step E. Develop Monitoring Plan (SUCCESS)

The fifth step involves deciding what indicators the project team will measure and how it will measure them. This step helps the project team see whether its strategies are working as planned.

- ***Identify indicators—***Develop indicators for each objective in the Action Plan, for key ecological attributes identified in the viability assessment (some will be directly linked to stated objectives), and other information needs.
- ***Select methods for data collection***—Specify one or more methods for collecting data for each indicator.
- ***Compile overall monitoring plan***—Assign specific responsibilities and develop a budget and timeline.
- ***Add indicators to chain of causation or conceptual model***—Show how indicators will map onto the project situation.

Step F. Implement Action and Monitoring Plans (STRATEGIES & SUCCESS)

The sixth step involves implementing the project's plans. This step is obviously the most important one in the process. Knowing if the proposed actions and monitoring efforts were implemented is critical from a learning perspective.

- ***Ensure action plan and monitoring plans are implemented***—Complete a brief checklist regarding the ongoing status of plans.
- ***Record any major deviations*** —Briefly record changes in plans.

Step G. Analyze and Communicate results and Use Information to Adapt and Learn (SUCCESS)

The seventh and final step involves analyzing the collected data and then communicating the results to TNC leaders, managers, and external audiences. This step completes the adaptive management process and allows us to adapt our actions for the project, add to organizational knowledge, and ultimately, change the practice of conservation. This step ensures that we learn from our experiences and avoid repeating our mistakes.

- ***Analyze data from monitoring efforts***—Summarize the results and document completed analyses.

- ***Communicate information to key people in the project***—Document how information has been shared with key members of the project team.
- ***Share lessons with other people***—Identify key audiences and briefly document how they have shared information with them.
- ***Use results to adapt action and monitoring plans***—Document changes made over time.
- ***Improve our collective knowledge***—Contribute findings to the institution in order to help develop the knowledge and capacity of the organization and the overall discipline of conservation.

Tools, Guidance Documents, and Presentations

The Enhanced 5S Project Management Process is supported by an Excel Workbook Tool that facilitates the entry and reporting for the majority of information associated with this process. The latest version of this tool is available for download from the following website:
http://www.conserveonline.org/2003/07/s/ConPrjMgmt_v4 A user manual for the Workbook Tool is available at
http://www.conserveonline.org/2004/03/a/CPM_User_Manual_v4a_0303

There are a large number of documents and presentations available that provide more detailed information on individual steps of the Enhanced 5S Project Management Process. The most recent versions of these files as of March 2004 have been compiled into an indexed collection on a CD and are available for download from ConserveOnline at http://www.conserveonline.org/2004/03/a/Enhanced_5S_Resources An Adobe Acrobat table (**INDEX_to_Enhanced_5-S_Resources.pdf**) provides a summary of each step of the Enhanced 5S Project Management process and includes hyperlinks for direct access to the resources on the CD or to the individual files when copied to another drive.

1.6.1.6 California Department of Fish and Game (The Resources Agency)

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CDFG is undergoing a re-organization relative to resource inventory and monitoring. They are in the early stages of this reorganization – identifying target species and stressors. The new approach is called the Resource Assessment Program (RAP) as defined below:

Species and Natural Communities Monitoring and Assessment Program, or Resource Assessment Program: The goal of this effort will be to develop and implement a long-term and strategic program to inventory, monitor, and assess the distribution and abundance of priority species, habitats, and natural communities in California (http://www.dfg.ca.gov/habitats/rap/default.html).

The Sierra-Cascades subgroup would be entity relevant to the SIEN network parks (Eric Loft is coordinator of this group). The foothills region is of highest priority, but the group also is active at some high elevation sites, and mid-elevation forests are a lower priority.

Currently a montane meadow monitoring and predictive modeling effort is underway to identify all important montane meadows in the Sierra. The project is an offshoot of earlier inventory/monitoring efforts for willow flycatcher, and now also includes great gray owl and blue grouse, and includes data collection on vegetation and physical habitat attributes. They may add amphibians to the list of species to be monitored.

A high mountain lakes and amphibians study also is ongoing on both east and west sides of the Sierra. This includes a comprehensive inventory of fish and amphibians.

The Department is working with other agencies on aspects of Sierra Nevada bighorn sheep/mountain lion work.